International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/5

PAPER 5 Practical Test

Monday **20 NOVEMBER 2000** Morning 1 hour 15 minutes

Candidates answer on the enclosed answer booklet.
Additional materials:
As listed in Instructions to Supervisors
Mathematical tables and/or Electronic calculator
300 mm rule

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer booklet.

Answer **all** questions.

Write your answers in the spaces provided on the answer booklet.

You are expected to record all your observations as soon as these observations are made. These observations and any arithmetical working of the answers from them should be written in the answer booklet; scrap paper should **not** be used.

An account of the method of carrying out the experiments is **not** required but you should record any precautions you take, and it must be clear (by diagrams or otherwise) how the readings were obtained. The theory of the experiments is **not** required.

At the end of the examination, hand in only the answer booklet.

INFORMATION FOR CANDIDATES

Graph paper is provided in the enclosed answer booklet. Additional sheets of graph paper should be used only if it is necessary to do so.

Question 1

In this experiment, you are to investigate the rate of cooling of a thermometer bulb.

Record all of your observations and readings on pages 2 and 3 of your Answer Booklet.

A thermometer is in a beaker of hot water.

Carry out the following instructions, referring to Fig. 1.1 and Fig. 1.2.

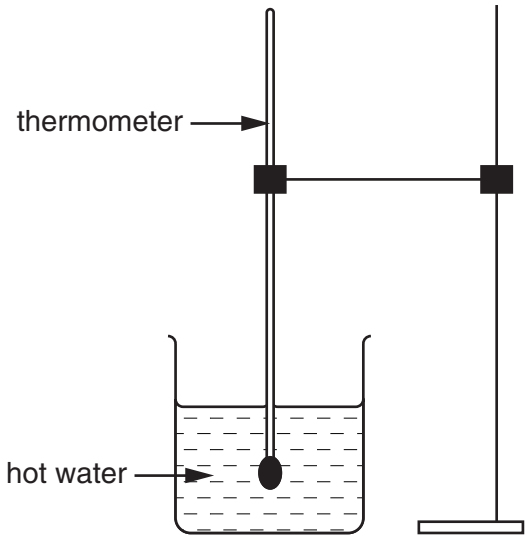

Fig. 1.1

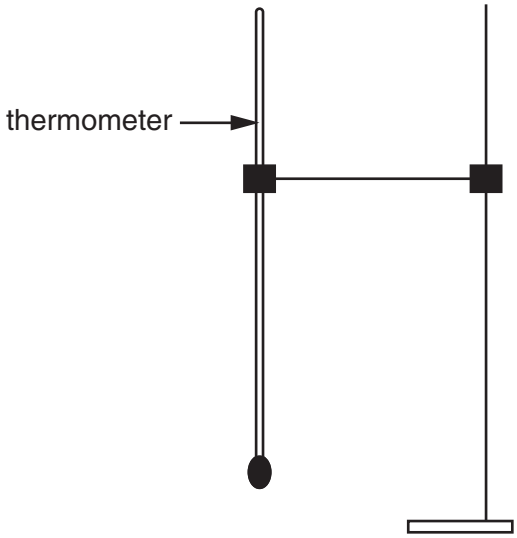

Fig. 1.2

(a) When the reading on the thermometer is steady, record the temperature reading. This will be the temperature at time = 0 s. Record this value in the table.

(b) As soon as possible after taking this reading, remove the thermometer from the water and start the stopclock at the same time.

(c) As the thermometer cools, record the thermometer reading every 30 s for 300 s.

(d) On the graph grid, plot the graph of temperature/°C (*y*-axis) against time/s (*x*-axis). Draw the best fit curve.

(e) Suggest a conclusion about how the rate of cooling of the thermometer bulb changes with time. Justify your conclusion by reference to the graph.

Question 2

In this experiment, you are to find the position of the centre of mass of an object.

Record all of your observations and answers on pages 4 and 5 of the Answer Booklet.

Carry out the following instructions referring to Fig. 2.1.

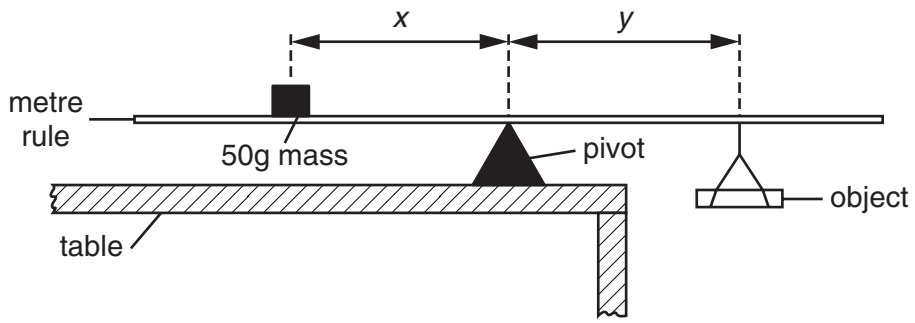

Fig. 2.1

(a) Place the metre rule on the pivot so that the 50 cm mark is directly over the pivot.

Place the 50 g mass (labelled **R**) on the metre rule at the 30 cm mark. Record *x*, the distance from the 30 cm mark to the pivot ($x = 20.0$ cm).

Hang the object from the metre rule and move it until the rule balances (do not change the position of the 50 g mass or the pivot). Measure and record *y*, the distance between the pivot and the point from which the object is hanging.

(b) Calculate *m*, the mass of the object, using the equation:

$$m = Rx/y \qquad \text{where } R = 50\text{ g}.$$

(c) Measure and record *d*, the length of the longest side of the object.

(d) Place the 50 g mass on the metre rule at the 30 cm mark. Measure and record *x*. Place the object **on** the metre rule, with the end marked '**A**' nearest the pivot. Move the object until the rule balances. Measure and record *z*, the distance from the pivot to the edge of the object marked '**A**'.

(e) Calculate *t*, the distance between the end of the object and its centre of mass using the equation:

$$t = (y - z) \qquad \text{where the value of } y \text{ is that measured in } \textbf{(a)}.$$

(f) Draw a diagram that shows the object, in its most stable position, when placed on a flat horizontal surface.

(g) Draw another diagram that shows the object, with one side flat on the surface, but in its least stable position when placed on the same surface. Label edge '**A**' on your diagram.

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Question 3

In this experiment, you are to investigate the passage of light rays through a transparent block.

Record all of your observations and readings on page 6 of your Answer Booklet.

Carry out the following instructions using the ray trace sheet (on page 7 of the Answer Booklet) and referring to Fig. 3.1.

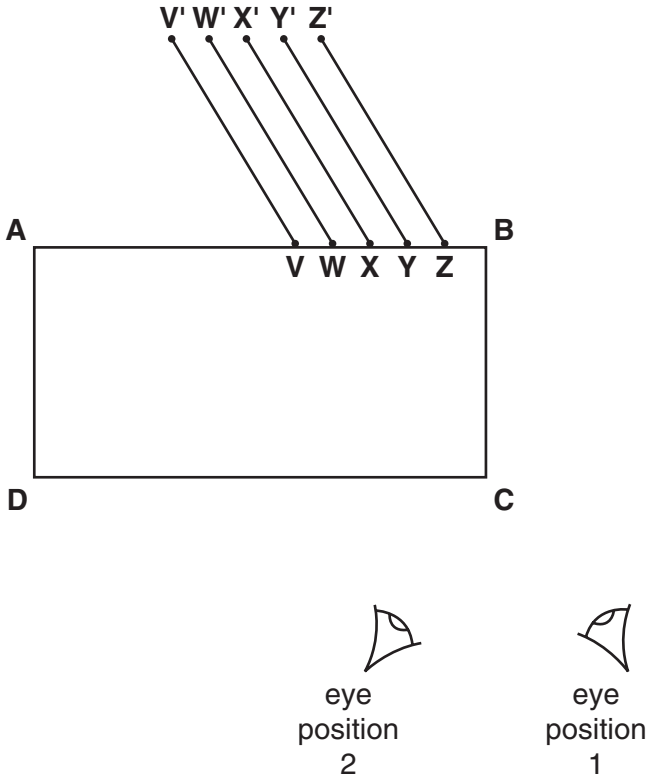

Fig. 3.1

(a) Place the ray trace sheet on the pin board provided. Place the transparent block on the sheet so that one corner is at point **B**, one of the long sides is exactly touching line **AB** and the shortest sides are vertical. Draw in the line **CD** exactly along the side of the block.

(b) Push a pin into the surface at point **V** and another pin at point **V'**. Measure and record *x*, the distance from **V** to **B**.

(c) View the two pins through the block from a direction as indicated on the diagram by '**eye position 1**'. Push in two pins, $\mathbf{P_1}$ and $\mathbf{P_2}$ between your eye and the block so that $\mathbf{P_1}$, $\mathbf{P_2}$, and the images of the pins at **V** and **V'** appear exactly one behind the other.

(d) Mark the positions of pins $\mathbf{P_1}$ and $\mathbf{P_2}$ on the ray trace sheet. Remove the pins. Using a rule, draw a line joining $\mathbf{P_1}$ and $\mathbf{P_2}$, and continue the line to meet the line **CD**.

(e) Repeat steps **(b)**, **(c)** and **(d)**, using the other positions (**W** and **W'** to **Z** and **Z'**). Record the corresponding values of *x* each time. If you cannot see the images of the two pins through the block from the direction of '**eye position 1**', move to the direction indicated by '**eye position 2**'.

(f) From your readings, estimate x_o, the largest value of *x* at which total internal reflection occurs.

(g) Sketch on the diagram in the Answer Booklet to show a ray travelling through the block and undergoing total internal reflection.

Question 4

In this experiment, you are to measure voltages across lamps in a circuit.

Record all of your observations and answers on page 8 of your Answer Booklet.

Carry out the following instructions, referring to Fig. 4.1.

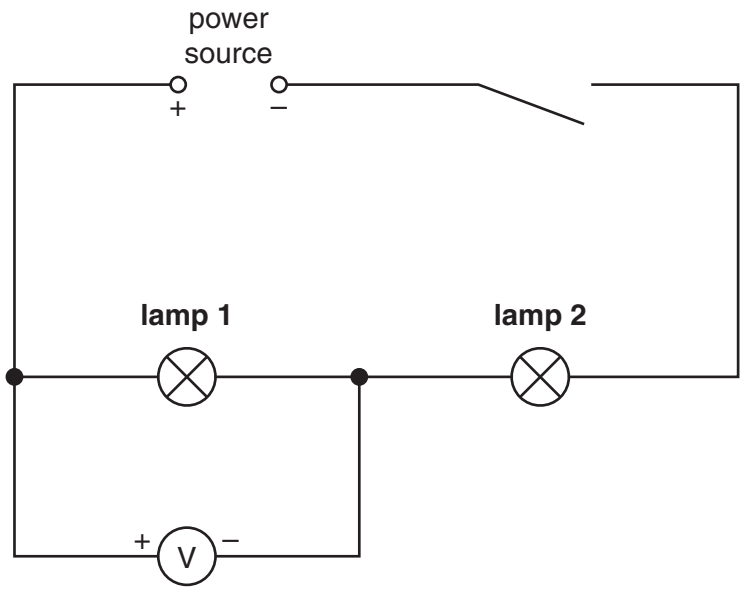

Fig. 4.1

(a) Set up the circuit as shown in Fig. 4.1.
Switch on. Record V_1, the voltage across **lamp 1**.
Switch off.

(b) Rearrange the circuit so that the voltmeter is connected in parallel with **lamp 2**.
Switch on. Record V_2, the voltage across **lamp 2**.
Switch off.

(c) Calculate V_1/V_2.

(d) What do you conclude about the resistance of **lamp 1** compared with the resistance of **lamp 2**? Explain, briefly, how your readings support this conclusion.

(e) It is proposed to set up a circuit for a second experiment so that
- the two lamps are connected in parallel
- a voltmeter is connected to measure the voltage across both lamps
- an ammeter is connected to measure the current through only one of the lamps
- a variable resistor controls the current through the other lamp only.

Draw a circuit diagram of a circuit that meets all of the above requirements. (You are **not** asked to set up this circuit.)

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